same rate that additional analyte molecules diffuse to the sampled region from surrounding regions, the reaction rate is approximately proportionate to the concentration of the analyte molecules. The current measured through the working electrode thus provides an indication of the analyte concentration.

[0046] The controller **150** can optionally include a display driver module **154** for operating a pixel array **164**. The pixel array **164** can be an array of separately programmable light transmitting, light reflecting, and/or light emitting pixels arranged in rows and columns. The individual pixel circuits can optionally include liquid crystal technologies, microelectromechanical technologies, emissive diode technologies, etc. to selectively transmit, reflect, and/or emit light according to information from the display driver module **154**. Such a pixel array **164** can also optionally include more than one color of pixels (e.g., red, green, and blue pixels) to render visual content in color. The display driver module **154** can include, for example, one or more data lines providing programming information to the separately programmed pixels in the pixel array **164** and one or more addressing lines for setting groups of pixels to receive such programming information. Such a pixel array **164** situated on the eye can also include one or more lenses to direct light from the pixel array to a focal plane perceivable by the eye.

[0047] The controller **150** can also include a communication circuit **156** for sending and/or receiving information via the antenna **170**. The communication circuit **156** can optionally include one or more oscillators, mixers, frequency injectors, etc. to modulate and/or demodulate information on a carrier frequency to be transmitted and/or received by the antenna **170**. In some examples, the eye-mountable device **110** is configured to indicate an output from a bio-sensor by modulating an impedance of the antenna **170** in a manner that is perceivably by the external reader **180**. For example, the communication circuit **156** can cause variations in the amplitude, phase, and/or frequency of backscatter radiation from the antenna **170**, and such variations can be detected by the reader **180**.

[0048] The controller **150** is connected to the bio-interactive electronics **160** via interconnects **151**. For example, where the controller **150** includes logic elements implemented in an integrated circuit to form the sensor interface module **152** and/or display driver module **154**, a patterned conductive material (e.g., gold, platinum, palladium, titanium, copper, aluminum, silver, metals, combinations of these, etc.) can connect a terminal on the chip to the bio-interactive electronics **160**. Similarly, the controller **150** is connected to the antenna **170** via interconnects **157**.

[0049] It is noted that the block diagram shown in FIG. **1** is described in connection with functional modules for convenience in description. However, embodiments of the eye-mountable device **110** can be arranged with one or more of the functional modules ("sub-systems") implemented in a single chip, integrated circuit, and/or physical feature. For example, while the rectifier/regulator **146** is illustrated in the power supply block **140**, the rectifier/regulator **146** can be implemented in a chip that also includes the logic elements of the controller **150** and/or other features of the embedded electronics in the eye-mountable device **110**. Thus, the DC supply voltage **141** that is provided to the controller **150** from the power supply **140** can be a supply voltage that is provided on a chip by rectifier and/or regulator components the same chip. That is, the functional blocks in FIG. **1** shown as the power supply block **140** and controller block **150** need not be implemented as separated modules. Moreover, one or more of the functional modules described in FIG. **1** can be implemented by separately packaged chips electrically connected to one another.

[0050] Additionally or alternatively, the energy harvesting antenna **142** and the communication antenna **170** can be implemented with the same physical antenna. For example, a loop antenna can both harvest incident radiation for power generation and communicate information via backscatter radiation.

[0051] The external reader **180** includes an antenna **188** (or group of more than one antennae) to send and receive wireless signals **171** to and from the eye-mountable device **110**. The external reader **180** also includes a computing system with a processor **186** in communication with a memory **182**. The memory **182** is a non-transitory computer-readable medium that can include, without limitation, magnetic disks, optical disks, organic memory, and/or any other volatile (e.g. RAM) or non-volatile (e.g. ROM) storage system readable by the processor **186**. The memory **182** can include a data storage **183** to store indications of data, such as sensor readings (e.g., from the analyte bio-sensor **162**), program settings (e.g., to adjust behavior of the eye-mountable device **110** and/or external reader **180**), etc. The memory **182** can also include program instructions **184** for execution by the processor **186** to cause the external reader **180** to perform processes specified by the instructions **184**. For example, the program instructions **184** can cause external reader **180** to provide a user interface that allows for retrieving information communicated from the eye-mountable device **110** (e.g., sensor outputs from the analyte bio-sensor **162**). The external reader **180** can also include one or more hardware components for operating the antenna **188** to send and receive the wireless signals **171** to and from the eye-mountable device **110**. For example, oscillators, frequency injectors, encoders, decoders, amplifiers, filters, etc. can drive the antenna **188** according to instructions from the processor **186**.

[0052] The external reader **180** can be a smart phone, digital assistant, or other portable computing device with wireless connectivity sufficient to provide the wireless communication link **171**. The external reader **180** can also be implemented as an antenna module that can be plugged in to a portable computing device, such as in an example where the communication link **171** operates at carrier frequencies not commonly employed in portable computing devices. In some instances, the external reader **180** is a special-purpose device configured to be worn relatively near a wearer's eye to allow the wireless communication link **171** to operate with a low power budget. For example, the external reader **180** can be integrated in a piece of jewelry such as a necklace, earing, etc. or integrated in an article of clothing worn near the head, such as a hat, headband, etc.

[0053] In an example where the eye-mountable device **110** includes an analyte bio-sensor **162**, the system **100** can be operated to monitor the analyte concentration in tear film on the surface of the eye. Thus, the eye-mountable device **110** can be configured as a platform for an ophthalmic analyte bio-sensor. The tear film is an aqueous layer secreted from the lacrimal gland to coat the eye. The tear film is in contact with the blood supply through capillaries in the structure of the eye and includes many biomarkers found in blood that are analyzed to characterize a person's health condition(s). For example, the tear film includes glucose, calcium, sodium,